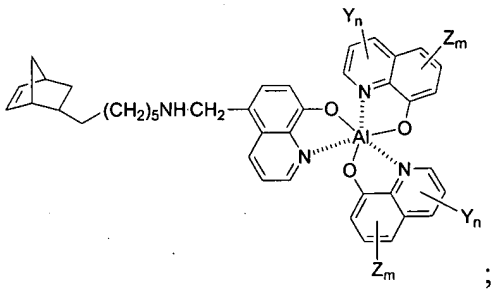
CLAIMS

We Claim:

1. An Alq_3-functionalized compound comprising a polymerizable moiety and an Alq_3-moiety, wherein q, in each instance, comprises an 8-hydroxyquinoline residue.

2. The Alq_3-functionalized compound of Claim 1, wherein the Alq_3-moiety is functionalized with at least one electron-donating group, at least one electron-withdrawing group, or a combination thereof.

3. The Alq_3-functionalized compound of Claim 1, wherein the Alq_3-moiety is functionalized with at least one group independently selected from: a hydrocarbyl group, an oxygen group, a sulfur group, a nitrogen group, a phosphorus group, an arsenic group, a carbon group, a silicon group, a germanium group, a tin group, a lead group, a boron group, an aluminum group, an inorganic group, an organometallic group, or a substituted analog thereof, any one of which having from 1 to about 30 carbon atoms; a halide; hydrogen; or any combination thereof.

4. The Alq_3-functionalized compound of Claim 1, wherein the compound has the formula 

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wherein Y and Z are independently selected from -F, -Cl, -Br, -I, $-R^1$, $-CR^1=O$, $-CH=CHC(O)R^1$, $-C(O)R^1$, $-C(O)OR^1$, -CN, $-C(NR^1)R^1$, $-C(NR^1)OR^1$, -

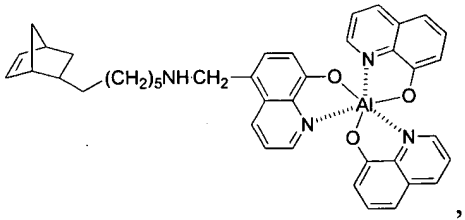
$CH_2C_6H_4X$, $-CH_2C_6H_3X_2$, $-CH_2C_6H_4R^1$, $-CH_2C_6H_3R^1_2$, $-CH_2CH_2C_6H_4X$, $-CH_2CH_2C_6H_3X_2$, $CH_2CH_2C_6H_4R^1$, $-CH_2CH_2C_6H_3R^1_2$, $-CH=CR^1_2$, $-C\equiv CR^1$, $-OR^1$, $-OC(O)R^1$, $-SiR^1_3$, $-OSiR^1_3$, $-NO_2$, $-NR^1_2$, $-N_3$, $-N=CR^1_2$, $-N=NR^1$, $-SR^1$, $-SX$, $-OSO_2R^1$, $-OSO_2OR^1$, $-SCN$, $-SO_2R^1$, $-PR^1_2$, $-PX_2$, $-P(O)R^1_2$, $-P(OR^1)_2$, $-P(O)(OR^1)_2$, $-OSiR^1_3$, $-OPR^1_2$, $-OAlR^1_2$, $-AsR^1_2$, $-As(O)R^1_2$, $-As(OR^1)_2$, $-As(O)(OR^1)_2$, SnR^1_3, $OSnR^1_3$, SnX^1_3, $OSnX^1_3$, $-BR^1_2$, $-BX_2$, $-BR^1X$, $-SO_2X$, $-OAlX_2$, $-OSiX_3$, $-OPX_2$, $-OSO_2X$, $-AsX_2$, or $-As(O)X_2$;

wherein R^1, in each instance, is independently selected from H or a substituted or unsubstituted hydrocarbyl group having from 1 to about 30 carbon atoms;

wherein X, in each instance, is independently selected from F, Cl, Br, I, H, OR^1, $-SR^1$, or NR^1_2; and

wherein n and m are independently selected from an integer from 0 to 3.

5. The Alq_3-functionalized compound of Claim 1, wherein the compound is selected from:



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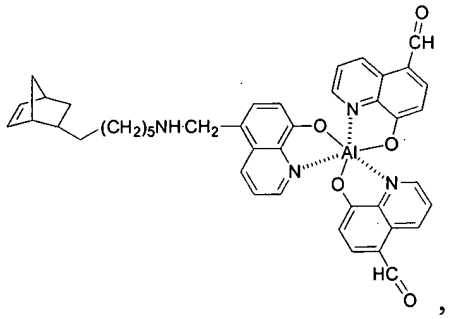

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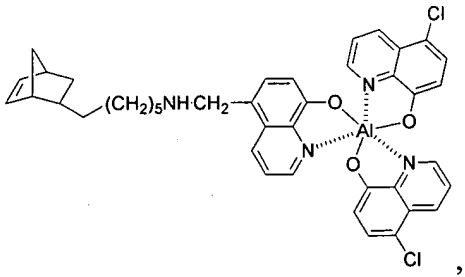

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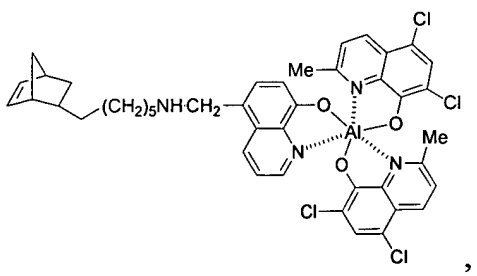

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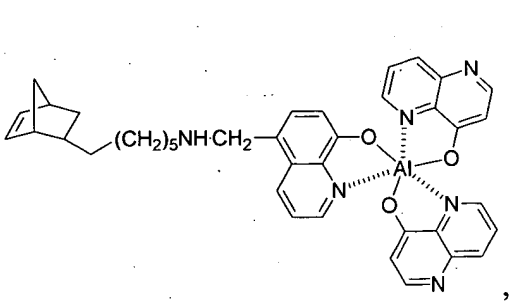

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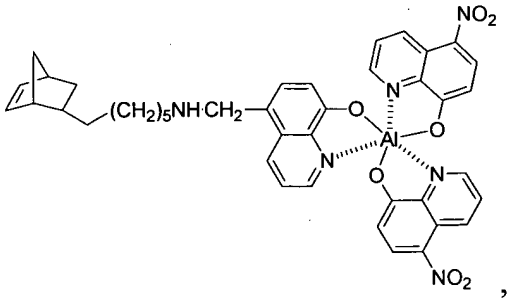

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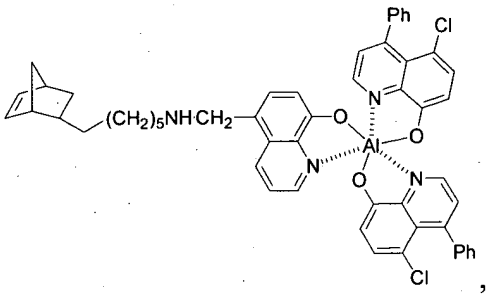

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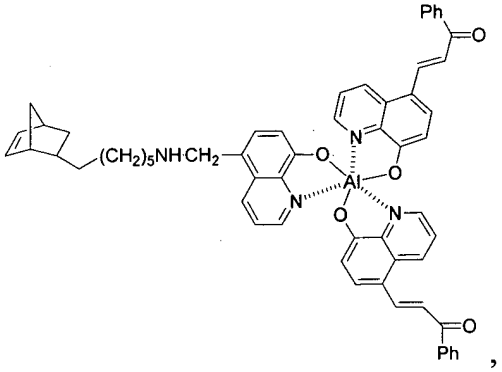

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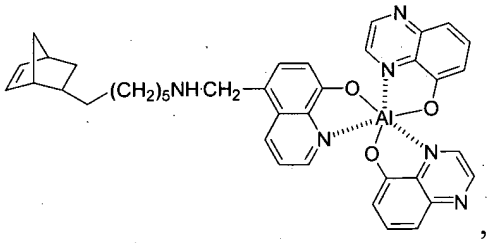

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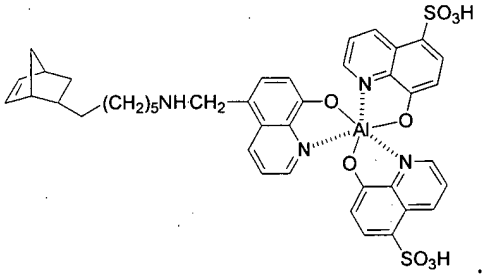

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6. A light-emitting diode comprising the polymerization product of the Alq_3-functionalized compound of Claim 1.

7. A composition comprising the polymerization product of an Alq_3-functionalized monomer, wherein the Alq_3-functionalized monomer comprises a polymerizable moiety and an Alq_3-moiety, and wherein q, in each instance, comprises an 8-hydroxyquinoline residue.

8. The composition of Claim 7, wherein the polymerization product is substantially non-crosslinked.

9. The composition of Claim 7, wherein the Alq_3-moiety is functionalized with at least one electron-donating group, at least one electron-withdrawing group, or a combination thereof.

10. The composition of Claim 7, wherein the polymerizable moiety comprises norbornene.

11. A light-emitting diode comprising the composition of Claim 7.

12. A composition comprising the polymerization product of at least one Alq_3-functionalized monomer and at least one comonomer, wherein the Alq_3-functionalized monomer comprises a polymerizable moiety and an Alq_3-moiety, and wherein q, in each instance, comprises an 8-hydroxyquinoline residue.

13. The composition of Claim 12, wherein the polymerizable moiety comprises norbornene, norbornadiene, cyclopentene, cyclooctene, cyclooctadiene, or a substituted analog thereof.

14. The composition of Claim 12, wherein the polymerizable moiety comprises norbornene or a substituted analog thereof.

15. The composition of Claim 12, wherein the Alq_3-moiety is functionalized with at least one electron-donating group, at least one electron-withdrawing group, or a combination thereof.

16. The composition of Claim 12, wherein the Alq_3-moiety is functionalized with at least one group independently selected from: a hydrocarbyl group, an oxygen group, a sulfur group, a nitrogen group, a phosphorus group, an arsenic group, a carbon group, a silicon group, a germanium group, a tin group, a lead group, a boron group, an aluminum group, an inorganic group, an organometallic

group, or a substituted analog thereof, any one of which having from 1 to about 30 carbon atoms; a halide; hydrogen; or any combination thereof.

17. The composition of Claim 12, wherein the Alq_3-moiety is functionalized with at least one group independently selected from -F, -Cl, -Br, -I, $-R^1$, $-CR^1{=}O$, $-CH{=}CHC(O)R^1$, $-C(O)R^1$, $-C(O)OR^1$, -CN, $-C(NR^1)R^1$, $-C(NR^1)OR^1$, $-CH_2C_6H_4X$, $-CH_2C_6H_3X_2$, $-CH_2C_6H_4R^1$, $-CH_2C_6H_3R^1{}_2$, $-CH_2CH_2C_6H_4X$, $-CH_2CH_2C_6H_3X_2$, $CH_2CH_2C_6H_4R^1$, $-CH_2CH_2C_6H_3R^1{}_2$, $-CH{=}CR^1{}_2$, $-C{\equiv}CR^1$, $-OR^1$, $-OC(O)R^1$, $-SiR^1{}_3$, $-OSiR^1{}_3$, $-NO_2$, $-NR^1{}_2$, $-N_3$, $-N{=}CR^1{}_2$, $-N{=}NR^1$, $-SR^1$, -SX, $-OSO_2R^1$, $-OSO_2OR^1$, -SCN, $-SO_2R^1$, $-PR^1{}_2$, $-PX_2$, $-P(O)R^1{}_2$, $-P(OR^1)_2$, $-P(O)(OR^1)_2$, $-OSiR^1{}_3$, $-OPR^1{}_2$, $-OAlR^1{}_2$, $-AsR^1{}_2$, $-As(O)R^1{}_2$, $-As(OR^1)_2$, $-As(O)(OR^1)_2$, $SnR^1{}_3$, $OSnR^1{}_3$, $SnX^1{}_3$, $OSnX^1{}_3$, $-BR^1{}_2$, $-BX_2$, $-BR^1X$, $-SO_2X$, $-OAlX_2$, $-OSiX_3$, $-OPX_2$, $-OSO_2X$, $-AsX_2$, or $-As(O)X_2$; wherein R^1, in each instance, is independently selected from H or a substituted or unsubstituted hydrocarbyl group having from 1 to about 30 carbon atoms; and wherein X, in each instance, is independently selected from F, Cl, Br, I, H, OR^1, $-SR^1$, or $NR^1{}_2$.

18. The composition of Claim 12, wherein the Alq_3-moiety is functionalized by at least one group independently selected from alkyl, cycloalkyl, alkenyl, alkynyl, aryl, aralkyl, formyl, acyl, imide, amide, imine, alkoxide, aryloxide, alkylthiolate, arylthiolate, alkoxyalkyl, haloalkyl, carboxylate, or a substituted analog thereof, any one of which having up to about 30 carbon atoms.

19. The composition of Claim 12, wherein the Alq_3-moiety is functionalized by at least one group independently selected from methyl, ethyl, propyl, cyclopropyl, n-butyl, tert-butyl, sec-butyl, isobutyl, cyclobutyl, amyl, isoamyl, pentyl, cyclopentyl, hexyl, cyclohexyl, cycloheptyl, heptyl, octyl, cyclooctyl, nonyl, decyl, dodecyl, 2-ethylhexyl, pentenyl, butenyl, benzyl, phenyl, tolyl, naphthyl, anthracenyl, F, Cl, Br, I, OMe, OEt, O-n-Pr, O-i-Pr, O-n-Bu, O-t-Bu, O-s-Bu, OPh, OC_6H_4Me, $OC_6H_3Me_2$, NMe_2, NEt_2, NPh_2, NHMe, NHEt, NHPh, -

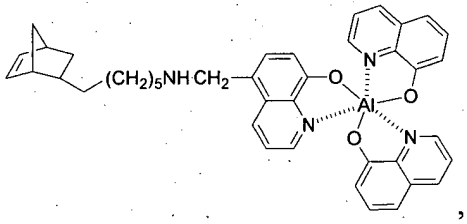
CH=O, -CH=CHC(O)Ph, or a substituted analog thereof, any one of which having up to about 30 carbon atoms.

20. The composition of Claim 12, wherein the Alq_3-functionalized monomer further comprises a chemical spacer between the polymerizable moiety and the Alq_3-moiety, having between 1 and about 30 carbon atoms.

21. The composition of Claim 20, wherein the chemical spacer is selected from $-(CH_2)_nNHCH_2-$ or $-(CH_2)_nNR^1CH_2-$, wherein n is from 1 to about 12, and R^1 is selected from a hydrocarbyl or substituted hydrocarbyl having from 1 to about 30 carbon atoms.

22. The composition of Claim 12, wherein the polymerization product comprises a block copolymer or a random copolymer.

23. The composition of Claim 12, wherein the Alq_3-functionalized monomer is selected from:



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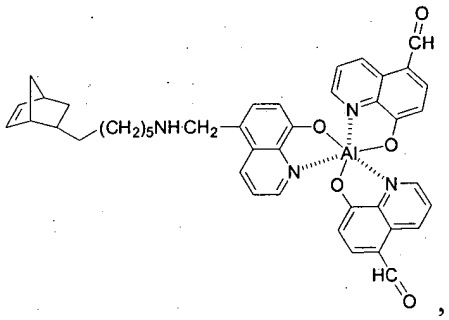

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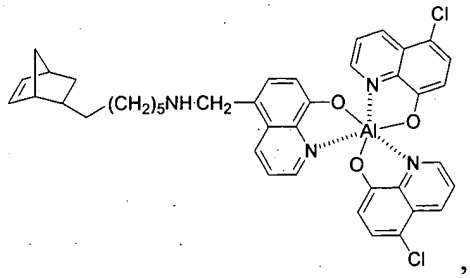

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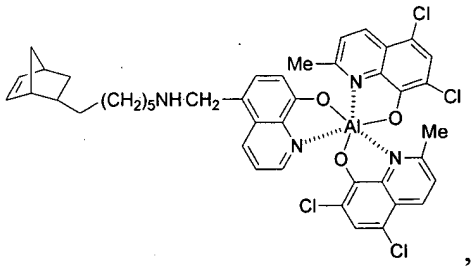

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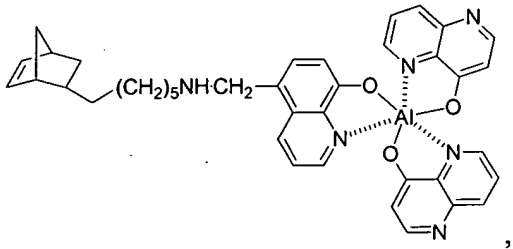

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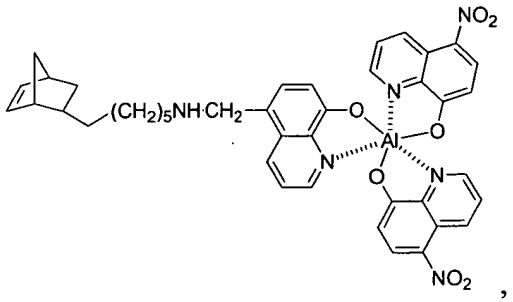

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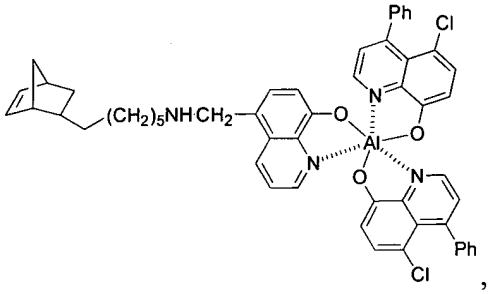

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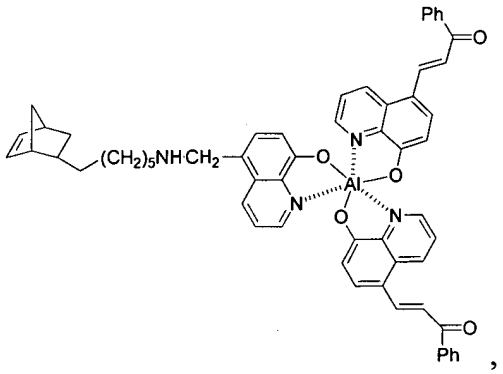

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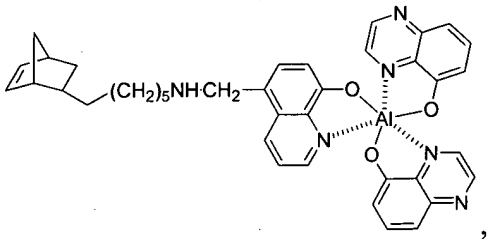

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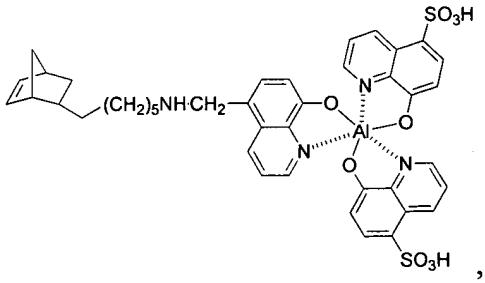

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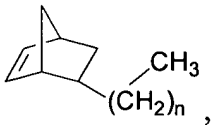
any combination thereof.

24. The composition of Claim 12, wherein the at least one comonomer comprises a compound with the formula 

, wherein n is an integer from 1 to about 12.

25. The composition of Claim 12, wherein the polymerization product is characterized by a polydispersity (M_w/M_n) from about 1.5 to about 1.8.

26. A light-emitting diode comprising the composition of Claim 12.

27. A method of making an Alq_3-functionalized polymer, comprising:

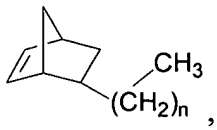
polymerizing an Alq_3-functionalized monomer in the presence or absence of at least one comonomer;

wherein the Alq_3-functionalized monomer comprises a polymerizable moiety and an Alq_3-moiety; and

wherein q, in each instance, comprises an 8-hydroxyquinoline residue.

28. The method of Claim 27, wherein the Alq_3-functionalized monomer is polymerized in the presence of at least one comonomer.

29. The method of Claim 27, wherein the Alq_3-functionalized monomer is polymerized in the presence of at least one comonomer, and wherein the molar ratio of Alq_3-functionalized monomer to comonomer is from about 1:1 to about 1:100.

30. The method of Claim 27, wherein the Alq_3-functionalized monomer is polymerized in the presence of at least one comonomer comprising  , wherein n is an integer from 1 to about 12.

31. The method of Claim 27, wherein the polymerizable moiety of the Alq_3-functionalized monomer is selected from norbornene, norbornadiene, cyclopentene, cyclooctene, cyclooctadiene, or a functionalized analog thereof.

32. The method of Claim 27, wherein the method comprises a ring-opening metathesis polymerization (ROMP) method.

33. The method of Claim 27, wherein the method comprises a radical polymerization method or a living radical polymerization method.

34. The method of Claim 27, wherein the polymerization is conducted in the presence of a catalyst comprising a transition metal carbene compound.

35. The method of Claim 27, wherein the polymerization is conducted in the presence of a catalyst comprising $Ru(CHPh)Cl_2[CHN_2(mesityl)_2C_2H_4](PCy_3)$.

36. The method of Claim 27, wherein the Alq_3-moiety is functionalized with at least one group independently selected from: a hydrocarbyl group, an oxygen group, a sulfur group, a nitrogen group, a phosphorus group, an arsenic group, a carbon group, a silicon group, a germanium group, a tin group, a lead group, a boron group, an aluminum group, an inorganic group, an organometallic group, or a substituted analog thereof, any one of which having from 1 to about 30 carbon atoms; a halide; hydrogen; or any combination thereof.

37. The method of Claim 27, wherein the Alq_3-moiety is functionalized with at least one group independently selected from -F, -Cl, -Br, -I, $-R^1$, $-CR^1{=}O$, $-CH{=}CHC(O)R^1$, $-C(O)R^1$, $-C(O)OR^1$, -CN, $-C(NR^1)R^1$, $-C(NR^1)OR^1$, $-CH_2C_6H_4X$, $-CH_2C_6H_3X_2$, $-CH_2C_6H_4R^1$, $-CH_2C_6H_3R^1{}_2$, $-CH_2CH_2C_6H_4X$, $-CH_2CH_2C_6H_3X_2$, $CH_2CH_2C_6H_4R^1$, $-CH_2CH_2C_6H_3R^1{}_2$, $-CH{=}CR^1{}_2$, $-C{\equiv}CR^1$, $-OR^1$, $-OC(O)R^1$, $-SiR^1{}_3$, $-OSiR^1{}_3$, $-NO_2$, $-NR^1{}_2$, $-N_3$, $-N{=}CR^1{}_2$, $-N{=}NR^1$, $-SR^1$, -SX, $-OSO_2R^1$, $-OSO_2OR^1$, -SCN, $-SO_2R^1$, $-PR^1{}_2$, $-PX_2$, $-P(O)R^1{}_2$, $-P(OR^1)_2$, $-P(O)(OR^1)_2$, $-OSiR^1{}_3$, $-OPR^1{}_2$, $-OAlR^1{}_2$, $-AsR^1{}_2$, $-As(O)R^1{}_2$, $-As(OR^1)_2$, $-As(O)(OR^1)_2$, $SnR^1{}_3$, $OSnR^1{}_3$, $SnX^1{}_3$, $OSnX^1{}_3$, $-BR^1{}_2$, $-BX_2$, $-BR^1X$, $-SO_2X$, $-OAlX_2$, $-OSiX_3$, $-OPX_2$, $-OSO_2X$, $-AsX_2$, or $-As(O)X_2$; wherein R^1, in each instance, is independently selected from H or a substituted or unsubstituted hydrocarbyl group having from 1 to about 30 carbon atoms; and wherein X, in each instance, is independently selected from F, Cl, Br, I, H, OR^1, $-SR^1$, or $NR^1{}_2$.

38. The method of Claim 27, wherein the Alq_3-moiety is functionalized by at least one group independently selected from alkyl, cycloalkyl, alkenyl, alkynyl, aryl, aralkyl, formyl, acyl, imide, amide, imine, alkoxide, aryloxide, alkylthiolate, arylthiolate, alkoxyalkyl, haloalkyl, carboxylate, or a substituted analog thereof, any one of which having up to about 30 carbon atoms.

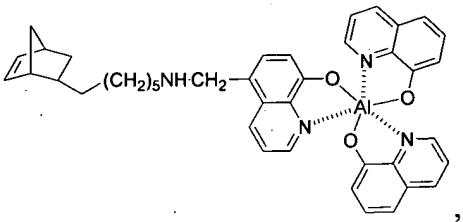
39. The method of Claim 27, wherein the Alq_3-moiety is functionalized by at least one group independently selected from methyl, ethyl, propyl, cyclopropyl, n-butyl, tert-butyl, sec-butyl, isobutyl, cyclobutyl, amyl, isoamyl, pentyl, cyclopentyl, hexyl, cyclohexyl, cycloheptyl, heptyl, octyl, cyclooctyl, nonyl, decyl, dodecyl, 2-ethylhexyl, pentenyl, butenyl, benzyl, phenyl, tolyl, naphthyl, anthracenyl, F, Cl, Br, I, OMe, OEt, O-n-Pr, O-i-Pr, O-n-Bu, O-t-Bu, O-s-Bu, OPh, OC_6H_4Me, $OC_6H_3Me_2$, NMe_2, NEt_2, NPh_2, NHMe, NHEt, NHPh, -CH=O, -CH=CHC(O)Ph, or a substituted analog thereof, any one of which having up to about 30 carbon atoms.

40. The method of Claim 27, wherein the Alq_3-functionalized monomer further comprises a chemical spacer between the polymerizable moiety and the Alq_3-moiety, having between 1 and about 30 carbon atoms.

41. The method of Claim 40, wherein the chemical spacer is selected from $-(CH_2)_nNHCH_2-$ or $-(CH_2)_nNR^1CH_2-$, wherein n is from 1 to about 12, and R^1 is selected from a hydrocarbyl or substituted hydrocarbyl having from 1 to about 30 carbon atoms.

42. The method of Claim 27, wherein the polymerization product comprises a block copolymer.

43. The method of Claim 27, wherein the Alq_3-functionalized monomer is selected from: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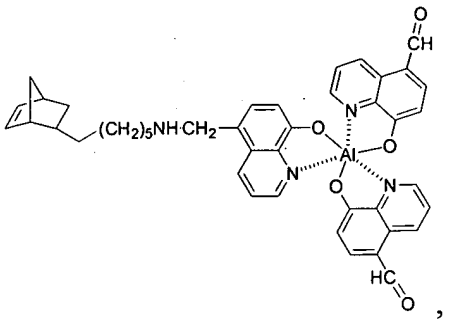
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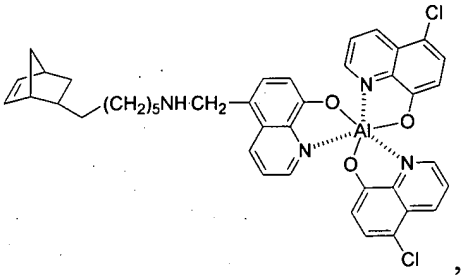
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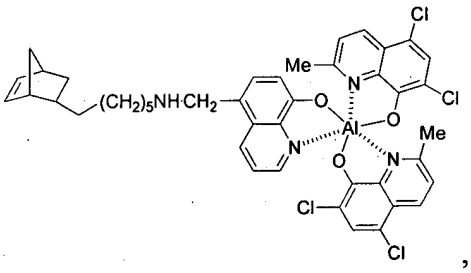
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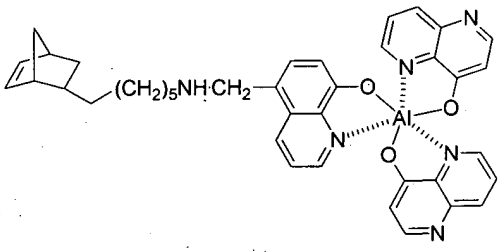
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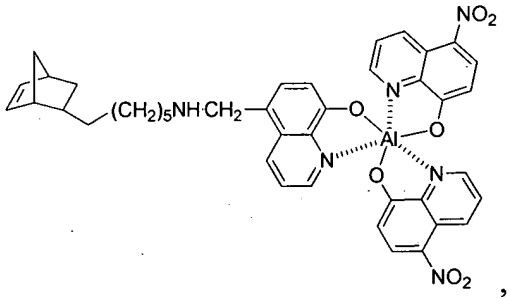
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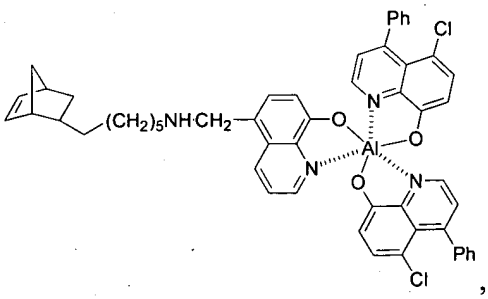
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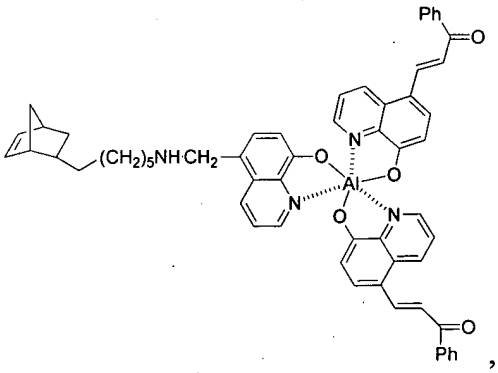
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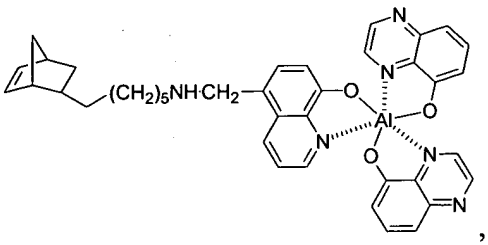

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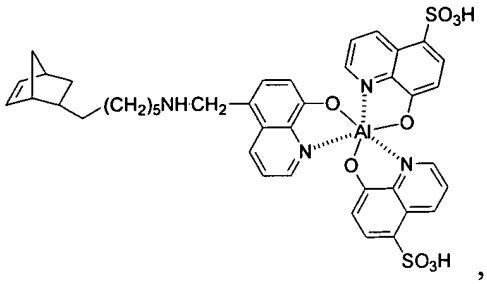


, or any combination thereof.

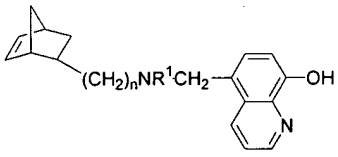
44. A method of functionalizing a polymer with an Alq_3 moiety, comprising:

providing an Alq_3-functionalized monomer; and

polymerizing an Alq_3-functionalized monomer in the presence or absence of at least one comonomer;

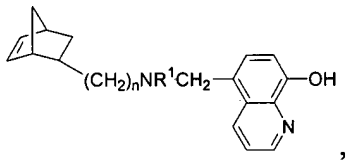
wherein the Alq_3-functionalized monomer comprises a polymerizable moiety and an Alq_3-moiety; and

wherein q, in each instance, comprises an 8-hydroxyquinoline residue.

45. A compound having the formula 

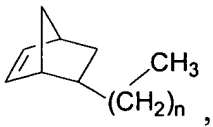
, wherein: n is from 1 to about 12; and R^1 is selected from H, a hydrocarbyl, or a substituted hydrocarbyl having from 1 to about 30 carbon atoms.

46. A composition comprising the polymerization product of:

1) a compound having the formula 

, wherein: n is from 1 to about 12; and R^1 is selected from H, a hydrocarbyl, or a substituted hydrocarbyl having from 1 to about 30 carbon atoms; and

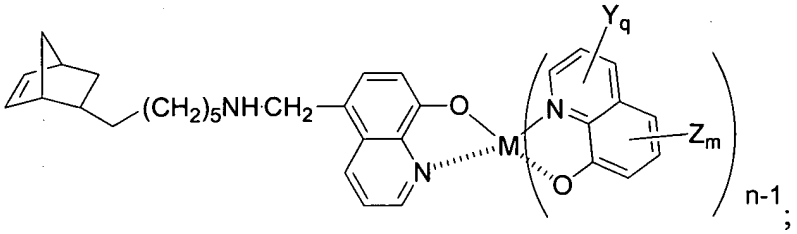
2) at least one optional comonomer having up to about 30 carbon atoms.

47. The composition of Claim 46, wherein the at least one comonomer comprises a compound with the formula  , wherein n is an integer from 1 to about 12.

48. An Mq_n-functionalized compound comprising a polymerizable moiety and an Mq_n-moiety, wherein q, in each instance, comprises an 8-hydroxyquinoline residue, and M is selected from Mg, Zn, Al, Ga, or In; and n is selected from 2 or 3 according to the valence of the metal.

49. The Mq_n-functionalized compound of Claim 48, wherein the Mq_n-moiety is functionalized with at least one electron-donating group, at least one electron-withdrawing group, or a combination thereof.

50. The Mq_n-functionalized compound of Claim 48, wherein the Mq_n-moiety is functionalized with at least one group independently selected from: a hydrocarbyl group, an oxygen group, a sulfur group, a nitrogen group, a phosphorus group, an arsenic group, a carbon group, a silicon group, a germanium group, a tin group, a lead group, a boron group, an aluminum group, an inorganic group, an organometallic group, or a substituted analog thereof, any one of which having from 1 to about 30 carbon atoms; a halide; hydrogen; or any combination thereof.

51. The Mq_n-functionalized compound of Claim 48, wherein the compound has the formula  ;

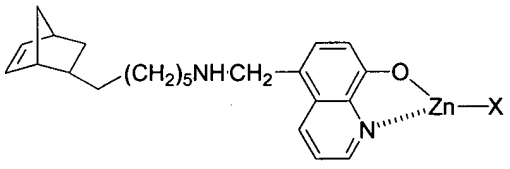
wherein Y and Z are independently selected from -F, -Cl, -Br, -I, -R^1, -CR^1=O, -CH=CHC(O)R^1, -C(O)R^1, -C(O)OR^1, -CN, -C(NR^1)R^1, -C(NR^1)OR^1, -$CH_2C_6H_4X$, -$CH_2C_6H_3X_2$, -$CH_2C_6H_4R^1$, -$CH_2C_6H_3R^1_2$, -$CH_2CH_2C_6H_4X$, -$CH_2CH_2C_6H_3X_2$, $CH_2CH_2C_6H_4R^1$, -$CH_2CH_2C_6H_3R^1_2$, -CH=CR^1_2, -C≡CR^1, -OR^1, -OC(O)R^1, -SiR^1_3, -OSiR^1_3, -NO_2, -NR^1_2, -N_3, -N=CR^1_2, -N=NR^1, -SR^1, -SX, -OSO_2R^1, -OSO_2OR^1, -SCN, -SO_2R^1, -PR^1_2, -PX_2, -P(O)R^1_2, -P(OR^1)$_2$, -P(O)(OR^1)$_2$, -OSiR^1_3, -OPR^1_2, -OAlR^1_2, -AsR^1_2, -As(O)R^1_2, -As(OR^1)$_2$, -As(O)(OR^1)$_2$, SnR^1_3, OSnR^1_3, SnX^1_3, OSnX^1_3, -BR^1_2, -BX_2, -BR^1X, -SO_2X, -$OAlX_2$, -$OSiX_3$, -OPX_2, -OSO_2X, -AsX_2, or -As(O)X_2;

wherein R^1, in each instance, is independently selected from H or a substituted or unsubstituted hydrocarbyl group having from 1 to about 30 carbon atoms;

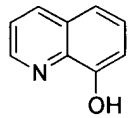
wherein X, in each instance, is independently selected from F, Cl, Br, I, H, OR^1, -SR^1, or NR^1_2; and

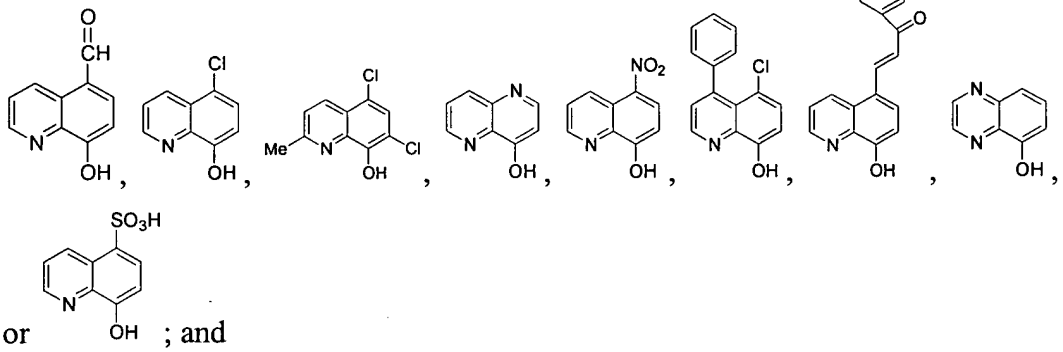
wherein q and m are independently selected from an integer from 0 to 3.

52. The Mq_n-functionalized compound of Claim 48, wherein:

the compound has the formula 

;

X is selected from an 8-hydroxyquinoline residue selected from  ,



or ; and

wherein the 8-hydroxyquinoline residue has been deprotonated.

53. A method of making a Mq_n-functionalized polymer, comprising:

preparing a q_n-functionalized monomer;

polymerizing the monomer in the presence or absence of a comonomer to form a q_n-functionalized polymer; and

reacting the polymer with a metal complex to form a Mq_n-functionalized polymer;

wherein M is selected from Mg, Zn, Al, Ga, or In; and n is selected from 2 or 3 according to the valence of the metal.